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THE/METHOD OF TREATING CANCER

This invention relates to the method of treating cancer.

BACKGROUND OF THE INVENTION

Cancer is believed to be caused by defective immune system. Many attempts have been made to improve immune system without success. Surprisingly it is found that Mycobacterium w containing compositions which are useful in improving immune status in patients with leprosy are also useful in management of cancer. They are found to be useful in decreasing burden of disease and reducing symptoms associated with cancer. More surprising was their synergy with conventional therapy inspite of fact that they work through entirely different mechanism. Still surprising was decrease in side effects of other therapy rather than increase in overall side effects inspite of use in same therapeutic amount alongwith increase in effect.

Prior Art

Treatment of cancer is has traditionally been approached though chemotherapy, coupled with radiotherapy for primary elimination of leukemias, neoplasms and tumours. In contrast surgery has been used to remove solid tumours. Therapy involves both curative and palliative leading to cure and reduction of suffering of the patient. Immunotherapeutic methods have also been found to be effective against a restrictive range of tumours of mesodermal origin suggesting that the immune system is capable of preventing or capable of delaying the growth of tumours in certain cases.

Traditionally BCG vaccine is used for boosting of immunity of individuals with cancer. This has not been well accepted as a mode of therapy due to inconclusive results. The only accepted method of BCG is to use it for bladder cancer by way of intravesicular therapy. The disadvantage associated with use of BCG is development of systemic and local tuberculosis caused by BCG. This is related to the fact that BCG contain live organism and they can be pathogenic to immunocompromised host.

US Patent 6,030,618 discloses an invention related to compositions, methods and kits for the prevention and treatment of primary and metastatic cancers and /or infectious diseases using heat shock/stress proteins (hsp) alone or in combination with each other and antigenic molecules to augment the immune responses to genotoxic and nongenotoxic factors, tumors, pathogens and infectious agents.

US Patent 5,767,156 provides a method of stimulating macrophage neutrophil and/or monocyte function in a subject. The method involves the administration of an effective amount of a free fatty acid having 18 - 24 carbon chain length with 2-6 double bonds and TNF or a TNF fragment or GM-CSF or interferon gamma.

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US Patent 6,080,725 is directed to vaccines comprising one or more bacterial, viral, or tumour-associated antigens; and one or more saponin-lipophile conjugate in which the lipophilic moiety such as a lipid, fatty acid, PEG, or terpene is covalently bonded to a non-acylated or deacylated triterpene saponin via a carboxyl group present on the 3-O-glucuronic acid of the triterpene saponin. The bacterial antigen in the vaccine are associated with a bacterial selected from diverse groups of bacteria including *Mycobacterium tuberculosis*.

US Patent 6,221,351 B1 relates generally to tumouricidal compositions and methods and more specifically to superantigens or enterotoxins derived from *Staphylococcus aureus*. Peptides homologous to the enterotoxins including shock syndrome toxin, *Streptococcal* pyrogenic exotoxins, mycoplasma and mycobacterial species, minor lymphocyte stimulating antigens, heat shock proteins, stress peptides, mammary tumour virus peptides, homologous synthetic polypeptides, biochemically derivatised enterotoxins, genetically engineered enterotoxins and fusion proteins. This invention also relates to superantigens expressed on the surface of lipid droplets in adjuvant-vehicle formulations or expressed in biologic cell surfaces as a result of enterotoxin gene transfection and used to produce a tumouricidal response in tumour bearing hosts. It also relates to enterotoxins and related compounds administered intravenously, subcutaneously, as in adjuvant form, or used extracorporeally in free or bound form to stimulate immunocytes, which are subsequently infused into tumour bearing tissues.

US Patent 6,090,385 discloses a method of treating a cancer patient which comprises administering to said patient an anti-tumour effective amount of at least one of a water-soluble thermostable macromolecular antigen complex which is interspecific of microorganisms of the *Mycobacteria*, *Nocardia*, and *Corynebacteria* group and which exhibits after electrophoresis an immuno-electrophoretic precipitation pattern corresponding to that of the antigen complex 60 of the *Mycobacterium bovis* Clmette Guerlin *Bacillus* strain, or immunogenic fragments of such a complex. It comprises an additional step of administering a therapeutic agent specific against the patient's cancer.

US Patent 6,056,964 suggests the delaying or preventing the growth or spread of breast or bronchial neoplasm which comprises administering to a subject in need of the same, antigenic and/or immunoregulatory material which comprises killed cells of *Mycobacterium vaccae* strain NCTC 11659 in an amount sufficient at least to delay or prevent the growth or spread of said neoplasm. This could be administered by intradermal injection.

US Patent 6,033,669 describes a method of stimulating the generation of cytotoxic T Cells (CTLs) in a patient, wherein the CTLs have the potential to destroy or attenuate cells presenting a characteristic disease-associated carbohydrate structure, which comprises administering to the patient an effective dose of a peptide/carbohydrate conjugate complex capable of generating cytotoxic T cell immunity against a carbohydrate structure, said conjugate structure comprising (i) a peptide component capable of binding an MHC class I molecule, and (ii) a carbohydrate component comprising of

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immunogenic specificity of said disease-associated carbohydrate structure and being of a size that enables a T-cell receptor to encompass an epitope of said disease-associated carbohydrate structure. This is claimed to be effective for treatment of melanoma, breast cancer, lung cancer or gastrointestinal cancer.

It has surprisingly been found that pharmaceutical compositions containing Mycobacterium W are effective in the treatment of a broad range of cancer indications. Pharmaceutical compositions as per present invention may contain extracts of Mycobacterium W alone or in combination of Mycobacterium W. As per another aspect of present invention pharmaceutical composition may contain other immunomodulator. It can be administered in various ways including intradermal, oral, intralesional etc. The present invention discloses such formulations and the method of their manufacture and use.

Mycobacterium W is a rapidly growing Mycobacterium which is not a pathogen.

Mycobacterium w is a non-pathogenic, cultivable, atypical mycobacterium, with biochemical properties and fast growth characteristics resembling those belonging to Runyons group IV class of Mycobacteria in its metabolic and growth properties but is not identical to those strains currently listed in this group. It is therefore thought that (M_w) is an entirely new strain. The species identity of M_w has been defined by polymerase chain reaction DNA sequence determination.

It has been found to share antigens with Mycobacterium leprae and Mycobacterium tuberculosis. It is found to provide prophylaxis against leprosy in humans by converting lepromin negative individuals to lepromin positivity. It is also found to provide prophylaxis against tuberculosis in animals. In leprosy it is also found to reduce duration of therapy for bacterial killing, clearance as well as clinical cure when used along with multi drug therapy.

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Summary of the invention

According to present invention, a pharmaceutical composition made from 'Mycobacterium w' (M_w) is found to be useful in the management of cancer. We have now found that the same therapeutic agent is useful in management of cancer. The use of Mycobacterium w containing formulations is associated with decrease in burden of cancer tissue, decreasing symptoms associated with cancer and improving quality of life. It also improves tolerance to other therapies.

Therapeutic agent which may be used in the present invention resembles M_w a non-pathogenic, cultivable, atypical mycobacterium, with biochemical properties and fast growth characteristics resembling those belonging to Runyons group IV class of Mycobacteria in its metabolic and growth properties but is not identical to those strains currently listed in this group. It is therefore thought that (M_w) is an entirely new strain.

The species identity of M_w has been defined by polymerase chain reaction DNA sequence determination and differentiated from thirty other species of mycobacteria. It however differs from those presently listed in this group in one respect or the other. By base sequence analysis of a polymorphic region of pattern analysis, it has been established that M_w is a unique species distinct from many other known mycobacterial species examined which are: M. avium, M. intracellulare, M. scrofulaceum, M. kansasii, M. gastri, M. gordonae, M. simiae, M. malmoense, M. haemophilum, M. terrae, M. nonchromogenicum, M. triviale, M. marinum, M. flavescens, M. slimian, M. szulgai, M. xenopi, M. asiaticum, M. aurum, M. smegmatis, M. vaccae, M. fortuitum subsp. fortuitum, M. fortuitum subsp. Peregrinum, M. chelonae subsp. Chelonae, M. chelonae subsp. Abscessus, M. genavense, M. tuberculosis, M. tuberculosis H₃₇R_v, M. paratuberculosis.

The object of the present invention is to provide a pharmaceutical composition containing 'Mycobacterium w' (M_w) for the treatment of cancer.

Another object of the present invention is to provide a pharmaceutical composition containing 'Mycobacterium w' (M_w) to improve quality of life in patient suffering from cancer.

Yet another object of the invention is to provide a pharmaceutical composition derived from mycobacterium w that are useful for the management of cancer.

Yet another object of the invention is to provide a pharmaceutical composition derived from Mycobacterium w to provide symptomatic relief for patients suffering from cancer.

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Yet another object of present invention is to provide a pharmaceutical composition which decreases side effects of standard therapy like radiotherapy, chemotherapy.

Yet another object of present invention is to provide an a pharmaceutical composition containing 'Mycobacterium w' (Mw) which decreases burden of cancer cells/tissues of primary and/or secondary (metastatic), sensitive and/or refractory to conventional treatment.

Yet another object of present invention is to provide a pharmaceutical composition which improves effect of conventional therapies.

Brief description of the drawings

Figure-1 is X ray non small cell lung cancer before treatment – subject 1

Figure-2 is X ray non small cell lung cancer after treatment –subject 1

Figure-3 is X ray non small cell lung cancer before treatment – subject 2

Figure-4 is X ray non small cell lung cancer after treatment –subject 2

Figure-5 is CT Scan report of patient operated for colorectal cancer with liver metastasis before treatment

Figure-6 is CT Scan report of patient operated for colorectal cancer with liver metastasis after treatment

DETAILED DESCRIPTION OF THE INVENTION

In accordance with the invention the composition of a pharmaceutical composition the method of preparation, HPLC characteristic its safety and tolerability, methods of use and outcome of treatments are described in following examples. The following are illustrative examples of the present invention and scope of the present invention should not be limited by them.

Example 1. The pharmaceutical compositions:

A. Each dose of 0.1 ml of therapeutic agent contains:

Mycobacterium w., (heat killed)	0.50 x 10 ⁹
Sodium Chloride I. P.	0.90% w/v
Tween 80	0.1% w/v
Thiomersal I. P.	0.01% w/v
(As a Preservative)	
Water for Injection I. P.	q. s. to 0.1 ml

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B. Each dose of 0.1 ml of therapeutic agent contains:

Mycobacterium w., (heat killed)	0.50 x 10 ⁹
Sodium Chloride I. P.	0.90% w/v
Trilon x 100	0.1% w/v
Thiomerosal I. P.	0.01% w/v
(As a Preservative)	
Water for Injection I. P.	q. s. to 0.1 ml

C. Each dose of 0.1 ml of therapeutic agent contains:

Mycobacterium w., (heat killed)	0.50 x 10 ⁹
Sodium Chloride I. P.	0.90% w/v
Thiomerosal I. P.	0.01% w/v
(As a Preservative)	
Water for injection I. P.	q. s. to 0.1 ml

D. Each dose of 0.1 ml of therapeutic agent contains

Extract of Mycobacterium w after sonication from 1x10 ¹⁰ Mycobacterium w.	
Sodium Chloride I. P.	0.90% w/v
Thiomerosal I. P.	0.01% w/v
(As a Preservative)	
Water for injection I. P.	q. s. to 0.1 ml

E. Each dose of 0.1 ml of therapeutic agent contains

Methanol Extract of 1x10 ¹⁰ Mycobacterium w	
Sodium Chloride I. P.	0.90% w/v
Thiomerosal I. P.	0.01% w/v
(As a Preservative)	
Water for Injection I. P.	q. s. to 0.1 ml

F. Each dose of 0.1 ml of therapeutic agent contains

Chloroform Extract of 1x10 ¹⁰ Mycobacterium w	
Sodium Chloride I. P.	0.90% w/v
Thiomerosal I. P.	0.01% w/v
(As a Preservative)	
Water for Injection I. P.	q. s. to 0.1 ml

G. Each dose of 0.1 ml of therapeutic agent contains

Acetone Extract of 1x10 ¹⁰ Mycobacterium w	
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Sodium Chloride I. P. ... 0.90% w/v
 Thiomerosal I. P. ... 0.01% w/v
 (As a Preservative)
 Water for Injection I. P. q. s. to 0.1 ml

H. Each dose of 0.1 ml of therapeutic agent contains

Ethanol Extract of 1×10^{10} Mycobacterium w
 Sodium Chloride I. P. ... 0.90% w/v
 Thiomerosal I. P. ... 0.01% w/v
 (As a Preservative)
 Water for Injection I. P. q. s. to 0.1 ml

I. Each dose of 0.1 ml of therapeutic agent contains

Litcase Extract of 1×10^{10} Mycobacterium w
 Sodium Chloride I. P. ... 0.90% w/v
 Thiomerosal I. P. ... 0.01% w/v
 (As a Preservative)
 Water for Injection I. P. q. s. to 0.1 ml

J. Each dose of 0.1 ml of therapeutic agent contains

Mycobacterium w (heat killed) 0.5×10^7
 Extract of mycobacterium w obtained 1×10^3 Mycobacterium w by disruption,
 solvent extraction or enzymatic extraction.
 Sodium Chloride I. P. ... 0.90% w/v
 Thiomerosal I. P. ... 0.01% w/v
 (As a Preservative)
 Water for Injection I. P. q. s. to 0.1 ml

Example 2. The Process of preparing a pharmaceutical composition

A. Culturing of Mycobacterium w.

i) Preparation of culture medium.

Mycobacterium w is cultured on solid medium like L J medium or liquid medium like middle brook medium or sauton's liquid medium. For better yield middle brook medium is enriched. It can be preferably enriched by addition of glucose, bactotryptone, and BSA. They are used in ratio of 20:30:2 preferably.

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The enrichment medium is added to middle brook medium. It is done preferably in ratio of 15:1 to 25:1 more preferably in ratio of 20:1.

ii) Bioreactor operation
a) Preparation of vessel

The inner contact parts of the vessel (Joints, mechanical seals, o-ring/gasket grooves, etc.) should be properly cleaned to avoid any contamination. Fill up the vessel with 0.1 N NaOH and leave as such for 24 H to remove pyrogenic materials and other contaminants. The vessel is then cleaned first with acidified water, then with ordinary water. Finally, the vessel is rinsed with distilled water (3 times) before preparing medium.

b) Sterilization of bioreactor

The bioreactor containing 9L distilled water is sterilized with live steam (indirect). Similarly the bioreactor is sterilized once more with Middlebrook medium. The other addition bottles, inlet/outlet air filters etc. are autoclaved (twice) at 121°C for 15 minutes. Before use, these are dried at 50°C oven.

c) Environmental parameter

i. Temperature: $37 \pm 0.5^{\circ}\text{C}$

ii. pH: 6.7 to 6.8 initially.

B. Harvesting and concentrating

It is typically done at the end of 6th day after culturing under aseptic condition. The concentration of cells (palletisation) is done by centrifugation.

C. Washing of cells

The pellet so obtained is washed minimum three times with normal saline. It can be washed with any other fluid which is preferably isotonic.

D. Adding pharmaceutically acceptable carrier.

Pyrogen free normal saline is added to pellet. Any other pyrogen free isotonic fluid can be used as a pharmaceutical carrier. The carrier is added in amount so as to get to desired concentration of active in final form.

E. Adding preservative

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To keep the product free from other contaminating bacteria for its self life preservative is added. Preferred preservative is thiomersol which is used in final concentration of 0.01 % w/v.

F. Terminal Sterilization

Terminal sterilization can done by various physical methods like application of heat or ionizing radiation or sterile filtration.

Heat can be in the form of dry heat or moist heat. It can also be in the form of boiling or pasturisation.

Ionizing radiation can be ultraviolet or gamma rays or microwave or any other form of ionizing radiation.

It is preferable to autoclave the final product.

This can be done before after filling in a final packaging.

G. Quality Control

i. The material is evaluated for purity, sterility.

ii. The organisms are checked for acid fastness after gram staining.

iii. Inactivation test : This is done by culturing the product on L J medium to find out any living organism.

iv. Pathogenicity and/or contamination with pathogen.

The cultured organisms are infected to Balb/c mice.

None of the mice should die and all should remain healthy and gain weight. There should not be any macroscopic or microscopic lesions seen in liver, lung spleen or any other organs when animals are killed upto 8 weeks following treatment.

v. Biochemical Test:

The organism is subjected to following biochemical tests:

a) Urease

b) Tween 80 hydrolysis

c) Niacin test

d) Nitrate reduction test

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The organism gives negative results in urease, tween 80 hydrolysis and niacin test. It is positive by nitrate reduction test.

H. Preparation of constituents of Mycobacterium w.

The constituents of Mycobacterium w can be prepared for the purpose of invention by:

- I. Cell disruption
- II. Solvent extraction
- III. Enzymatic extraction.

The cell disruption can be done by way of sonication or use of high pressure fractionometer or by application of osmotic pressure ingredient.

The solvent extraction can be done by any organic solvent like chloroform, ethanol, methanol, acetone, phenol, isopropyl alcohol, acetic acid, urea, hexane etc.

The enzymatic extraction can be done by enzymes which can digest cell wall/membranes. They are typically proteolytic in nature. Enzyme liticase and pronase are the preferred enzymes. For the purpose of invention cell constituents of Mycobacterium w can be used alone in place of mycobacterium w organisms or it can be added to the product containing mycobacterium w.

Addition cell constituents results in improved efficacy of the product.

Example 3. Characteristics of constituents of Mycobacterium w by HPLC analysis.

The constituents of mycobacterium w. used for the purpose of invention when subjected to HPLC analysis gives a single peak at 11 minutes. No other significant peaks are found beyond. The peak is homogenous and devoid of any notch suggesting homogeneity of material obtained

HPLC analysis was done using a waters system high performance liquid chromatography apparatus

Column:	Novapak c1860A, 4 μ m, 3.9 x 150mm.
The guard column:	Novapak c 18
Column Temperature:	30° c
Flow rate:	2.5 ml/min

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Injection volume: 25 μ L.

Mobile phase:

Solvent A: HPLC grade methanol.

Solvent B: HPLC grade methylene chloride

Binary gradient:

The HPLC gradient initially comprised 98%(v/v) methanol (solvent B).

The gradient was increased linearly to 80%.

A and 20% B at one minute; 35% A and 65% B at 10 minutes, held for 5 seconds and then decreased over 10 seconds back to 98% A and 2% B.

Example 4. Management of cancer refractory to standard treatment.

CASE 1:

A 70 year old female suffering from multiple myeloma was receiving malphalan and prednisolone as therapy for 5 years. The disease recurred with bone pain. Her general condition was poor and she was bedridden. Her hemoglobin was reduced to 5.5 gm. She was put on Intradermal Injection of a pharmaceutical composition containing mycobacterium as per present invention. It was given as 0.1 ml Intradermally over deltoid region at the interval of one week. At the end of 3 months she is symptoms general condition has improved drastically and she is able to walk on her own. Her hemoglobin value has risen to 7.7 gm/dl from 5.5 gm/dl in absence of any specific treatment on anaemia.

CASE 2

A 50 year old postmenopausal woman underwent lumpectomy for a fungating mass in her left breast (carcinoma breast T₄ N₁ M₁). The tumor was hormone independent and receptor status for estrogen and progesterone was negative. Following surgery she developed cough and breathlessness. It was found to be due to large metastatic lesion in her chest. A pharmaceutical composition as per present invention was added to her therapy. At the end of three months, there was a remarkable improvement in her cough and breathlessness. X-ray chest showed 25% decrease in size of metastatic lesion. The mycobacterium containing pharmaceutical composition as per present invention was administered Intradermally over deltoid region.

CASE 3

A 68 year old male suffering from carcinoma esophagus-mid third had received radiotherapy and was on chemotherapy (one cycle completed). He developed dysphagia due to progress of disease. He also had neutropenia with fall in total WBC count. Therapy with a pharmaceutical composition was started. It resulted in improvement in his symptoms gradually. At the end of three months. The swallowing became normal with improvement in general condition and

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normalization of WBC count. The pharmaceutical composition as per present invention was given as 0.1ml intradermally at weekly interval 2nd dose was delayed and administered at the interval of 15 days instead of 1 week. It comprised of 0.3ml instead of 0.1 ml.

In case 1 and 3 improvement was seen inspite of absence of chemotherapy while in case 2 chemotherapy (FAC) also continued.

Thus this cases illustrates that pharmaceutical compositions containing Mycobacterium w (Mw) as per present invention are useful in treatment of cancer which are refractory to standard therapy. Their use is associated with amelioration of symptoms, improvement in general well being and quality of life, improvement in other associated conditions like anemia, neutropenia.

Example 5. Effect of pharmaceutical composition on cancer when used alone.

Superficial bladder cancer presents as hematuria. It is amenable to various forms of therapy. Drugs used to achieve remission are given Intravesically e.g. doxorubicin or BCG.

In four patients with superficial bladder cancer diagnosed cystoscopically pharmaceutical composition as per present invention was given intradermally. It was given as 0.1ml every month. By six weeks (after two injections) everybody became asymptomatic. Eight weeks later cystoscopy was performed. Surprisingly it was found that there was absence of any detectable lesion cystoscopically. Six months followup did not reveal any recurrence of symptoms. Cystoscopy also revealed normal bladder mucosa with absence of detectable lesion.

Thus findings are suggestive of effect of pharmaceutical composition containing mycobacterium w as effective therapy in management of bladder cancer when given intradermally over deltoid region.

Example 6. Effect of Mycobacterium w when radiotherapy is not adequate.

Muscle Invasive bladder cancer.

Muscle Invasive bladder cancer (T₄) can be managed by radical cystectomy. However it is desirable to preserve bladder. Radiotherapy and/or chemotherapy are not adequate in achieving local control/remission of disease.

Five patients with muscle Invasive bladder cancer were treated by intradermal injection of Mycobacterium w over both deltoid. The intradermal Mycobacterium

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w was repeated every month on any on deltoid for six months. All received standard radiotherapy for a total of 71 gy.

At the end of two months all were symptom free. Cystoscopy and computerized axial tomography (T scan) failed to reveal any detectable lesion suggesting complete remission of disease. All are disease free after a followup of 8 months or longer after beginning therapy.

Thus mycobacterium w is effective in achieving complete remission and maintaining it.

No side effects were noticed by any of the patients.

Example 7. Effect of Mycobacterium w when chemotherapy is not adequate.

Non small cell lung cancer.

Non small cell lung cancer is difficult to manage. It usually does not respond well to chemotherapy or radiotherapy. The response rate is inversely proportionate to extent of disease. In disease with extent T₄ surgery is not indicated and chemotherapy and/or radiotherapy has hardly any effect and carries poor prognosis.

Thus findings of this study suggests that mycobacterium w has significant effect on difficult to treat cancer.

Example 8. Effect of Mycobacterium w containing therapy on Quality of life and side effects of chemotherapy

a) Carcinoma breast with bone metastasis.

In a controlled study involving 20 patients with a breast cancer and bone metastasis effect of mycobacterium w was evaluated. All patients received chemotherapy in the form of cyclophosphamide, adriamycin and 5-fluorouracil. Mycobacterium w containing compositions were given as intradermal injections of 0.1 ml every week for two months followed by every 15 days for two months and monthly for two months for a total duration six months. 10 patients of 20 randomly received it while remaining 10 were kept as controls.

None of the patients in treatment group developed diarrhoea and vomiting compared to 8 of 10 patients in control group. Mucositis was seen in 1 patient in treatment group compared to 5 patients in control group. Bone marrow depression as manifested by leucopenia, thrombocytopenia and anemia was seen in 2 patients in treatment group and 6 patients in control group. There was

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In crease in weight in 3 patients in treatment group while none of the patients showed increase in weight. All patients had remarkable improvement in quality of life in treatment group which was not seen in any one in control group.

b) Head and neck cancer.

In a controlled study in 20 patients with histologically proven advanced head and neck cancer with minimum of 6 months expectancy effect of mycobacterium w was evaluated. Each patient received chemotherapy containing cisplatin and 5-FU. Mycobacterium w was given to randomly selected 10 patients as 0.1 ml intradermally over deltoid region every 15 days for 3 months. The first dose was given as 0.2 ml divided over two deltoid region.

The chemotherapy induced hematological side effects resulted in postponement of chemotherapy in 2 out of 10 patients in treatment group and 5 out of 10 patients in control group.

Mucositis was evident on day 15 after chemotherapy. It was seen in 2 patients in treatment group and 6 patients in control group.

Nausea/vomiting was seen in all patients in control group while in none in treatment group.

Thus use of mycobacterium w was useful in reducing side effects of chemotherapy.

Example 9. Use of Mycobacterium w in terminally sick patients with cancer.

A 65 year old male patient was diagnosed to have carcinoma pancreas with metastasis in liver and lung. He was judged to be terminally ill with incurable cancer was not offered any treatment. He developed extensive cough and breathlessness and was unable to sleep. He was administered Mycobacterium w 0.3 ml intradermally biweekly. Within 10 day his cough was controlled and general condition showed improvement. He started doing all his routine work by himself and started getting normal sleep. If for some reason administration of Mycobacterium w was delayed beyond 4 days there used to be recurrence of cough and disturbances in sleep. He lived for 14 weeks after therapy and died natural death. X-ray chest taken before and two months after showed some improvement in lesion. He did not receive any other therapy all throughout.

Thus Mycobacterium w was useful in ameliorating symptoms in terminally ill patient due to cancer.

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